INSTRUCTION MANUAL
FOR

MODEL TTS 66XTSA
TONE SIGNALING ADAPTER

NORTHEAST ELECTRONICS CORPORATION

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TONE SIGNALING ADAPTER

ISSUE 1

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PRINTED IN USA APR 1971

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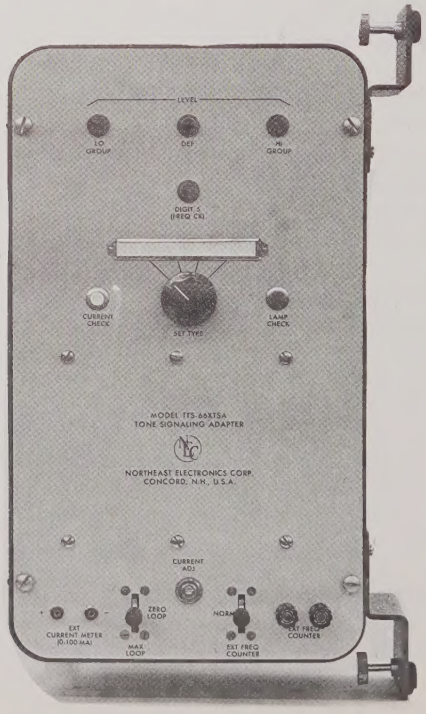

Figure 1-1. Model TTS 66XTSA Tone Signaling Adapter

SECTION 1

DESCRIPTION

1.1 GENERAL.

1.2 The Northeast Electronics Corporation Model TTS 66XTSA Tone Signaling Adapter is an accessory designed for use with the Model TTS 66 Telephone Repair Test Set. It provides go/no-go tone testing of dual frequency signaling type telephone sets such as TOUCH TONE* and similar types. The adapter mounts on either side of the TTS 66 case and receives operating power from the TTS 66C Control Unit. (See figure 1-1.)

1.3 FUNCTIONS.

1.4 Two separate set types can be tested at both zero loop and maximum loop conditions. A reference telephone set is first used to calibrate the TTS 66XTSA and then sets are tested against this reference set on a go/no-go basis. Indicator lamps are lighted when the low group and high group tone levels are within preset limits. An indicator is lighted when either of the low or high group tone levels is not within the preset limits. A separate frequency check is performed when button 5 on the telephone set is pressed. If the 770 Hz and 1336 Hz tone frequencies are within the required accuracy, an indicator lamp is lighted. Connectors are provided for use of external test equipment such as an ammeter, frequency counter, and VTVM.

* TOUCH TONE is a Western Electric Company registered trademark.

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SECTION 2

SPECIFICATIONS

2.1 GENERAL.

2.2 Table 2-1 lists the specifications for the TTS 66XTSA Tone Signaling Adapter.

Table 2-1 Specifications

Selective detector card 4 tuned circuit accuracy	770 Hz ±2% 1336 Hz ±2%
Dual threshold detector cards 1 and 2 threshold level accuracy	± 1 dB
Input level dynamic range	10 dB
Supply voltage required	-44VDC to -52VDC

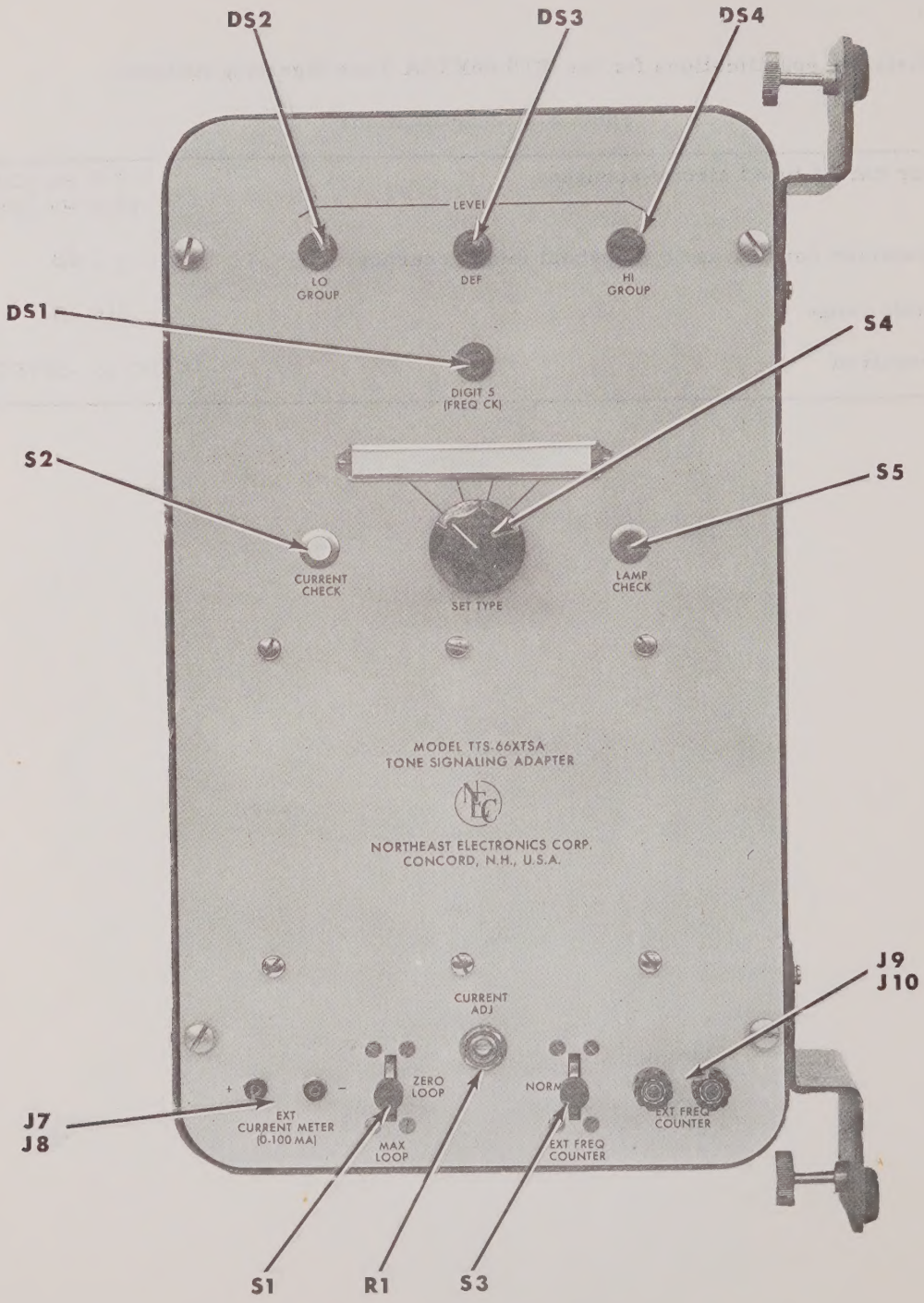


Figure 3-1. Model TTS 66XTSA Front Panel Controls.

SECTION 3

INSTALLATION AND OPERATING INSTRUCTIONS

3.1 GENERAL. Paragraphs 3.2 and 3.3 provide installation instructions and paragraphs 3.4 through 3.16 the operating instructions. Table 3-1 lists the operating controls shown on figure 3-1.

Table 3-1. Operating Controls

Control, Indicator or Connector	Ref Desig.	Function
LO GROUP LEVEL indicator	DS2	When lighted, indicates low group level is within preset limits.
HI GROUP LEVEL indicator	DS4	When lighted, indicates high group level is within preset limits.
DEF LEVEL indicator	DS3	When lighted, indicates low or high group level is not within preset limits.
DIGIT 5 (FREQ CK)	DS1	When lighted, (pushbutton 5 pressed) indicates that both 770 Hz and 1336 Hz tones are present.
LAMP CHECK pushbutton	S5	When pressed, indicators DS1, DS2 and DS4 are lighted.
SET TYPE switch	S4	Selects one of four telephone types that can be tested. The maximum is two if both zero and maximum loop conditions are checked.
CURRENT CHECK pushbutton	S2	When pressed and when a telephone is connected to the test set, the line current can be measured with an ammeter connected to EXT CURRENT METER pin jacks.
EXT FREQ COUNTER binding posts	J9 and J10	Provides connections across input lines L1 and L2 for use of external test equipment.
NORM/EXT FREQ COUNTER switch	S3	When set to EXT FREQ COUNTER position, input lines L1 and L2 are connected to EXT FREQ COUNTER binding posts J9 and J10. In NORM position, input lines are connected to internal circuits.
CURRENT ADJ screw-driver adjustment	R1	Adjusts telephone maximum loop line current.
ZERO LOOP/MAX LOOP switch	S1	When set to ZERO LOOP, telephone set is checked under minimum loop resistance conditions. When set to MAX LOOP, telephone set is checked under maximum loop resistance conditions as set by CURRENT ADJ potentiometer R1.
EXT CURRENT METER (0-100 MA) pin jacks	J7 and J8	When ammeter is connected to the jacks and CURRENT CHECK switch S2 is pressed, the telephone set current is measured.

2 INSTALLATION.

.3 The Model TTS 66XTSA Tone Signaling Adapter s designed to be mounted on the Model TTS 66 elephone Repair Set side panel opposite the TS 66-2AC Acoustical Chamber. If it is desired o mount the adapter on the side opposite that for hich it is set up, loosen the four screws on the TS 66XTSA front panel, lift the panel out of the ase, rotate the panel 180 degrees, and set the anel back in the case. Ensure that in-line con- ector is not positioned under the circuit board age. Tighten the four screws. To install the TS 66XTSA perform the following steps:

a. Using the two captive screws, mount the TTS 66XTSA to the side of the TTS 66.

b. Connect P3 to J3 (mounted on TTS 66RP Rear Panel).

c. If the TTS 66C Control Panel has a serial number of 105 or lower and it is desired to use the foot switch and the control panel, minor wiring changes to the control panel must be made as instructed in paragraph 3.17. However, the foot switch can be used without modifying the TTS 66C if P3 on the TTS 66XTSA cord (connected to the TTS 66RP Rear Panel) is first disconnected.

.4 OPERATION.

.5 Operating procedures consist of preliminary teps, selection of representive telephone sets, alibration adjustments, and telephone set testing.

.6 PRELIMINARY PROCEDURE. The following teps should be performed each time that a test equence is started:

a. On TTS 66C Control Panel, set POWER switch to ON and TEST SEQUENCE switch to REMOTE CONTROL.

NOTE

Allow equipment to stabilize for five minutes before proceeding.

b. On TTS 66XTSA, set ZERO LOOP/MAX LOOP switch to ZERO LOOP, NORM/EXT FREQ COUNTER switch to NORM, and SET TYPE switch fully counterclockwise.

c. Press LAMP CHECK pushbutton. All indicators must be lighted. The red LEVEL DEF indicator should be lighted at all times when no test tones are entering TTS 66XTSA. Replace any defective indicator lamps before proceeding.

3.7 REFERENCE TELEPHONE SET SELECTION. The following procedure must be used when it is necessary to experimentally select a representive telephone set from the group of sets to be tested prior to testing telephone sets. When a telephone set exists that is known to have the desired tone level specifications, the procedure outlined in this paragraph can be eliminated. In this case, use this reference set to perform the TTS 66XTSA calibration procedure starting at paragraph 3.8. If the telephone set tone levels are to be tested for both zero loop and maximum loop performance, the TTS 66XTSA can be calibrated to test two different set types. All set types tested must have identical upper and lower go/no-go level limits. If this is not the case, the TTS 66XTSA must be recalibrated for each set of limits before testing. The different set types can, however, have different nominal tone level requirements. To select a reference telephone set, perform the following steps:

NOTE

The ac voltmeter used in the following procedure must be a high impedance type such as a VTVM.

a. Label and mark each set to be used in selecting reference set.

b. Connect VTVM to EXT FREQ COUNTER binding posts on TTS 66XTSA.

c. Set NORM/EXT FREQ COUNTER switch to EXT FREQ COUNTER.

d. Connect first set to L1, L2 and G terminals on TTS 66C Control Panel.

NOTE

It may be necessary to reverse L1 and L2 connections to obtain proper set operation.

e. On telephone set, simultaneously press buttons 4 and 5.

f. Record VTVM indication. This is zero loop, low frequency group representative level for this set.

g. Release buttons and simultaneously press buttons 2 and 5.

h. Record VTVM indication. This is zero loop, high frequency group representative level.

i. Release buttons and set ZERO LOOP/ MAX LOOP switch to MAX LOOP.

j. Connect 0 to 100mA dc ammeter to EXT CURRENT METER jacks.

k. Press CURRENT CHECK button and adjust. CURRENT ADJ potentiometer to obtain desired maximum loop current.

NOTE

This current level must not be changed for the remainder of the tests on the type set for which it was adjusted.

l. Remove ammeter.

m. On telephone set, simultaneously press buttons 4 and 5.

n. Record VTVM indication. This is maximum loop, low frequency group representative level.

o. Release buttons and simultaneously press buttons 2 and 5.

p. Record VTVM indication. This is maximum loop, high frequency group representative level.

q. Repeat steps d through p; omitting steps j,k,l; for as many sets as necessary to obtain an adequate sampling.

r. Analyze the recorded levels and select the set that most nearly meets the desired specifications.

s. Repeat steps a through r for additional set types as required.

3.8 TTS 66XTSA CALIBRATION-FIRST SET TYPE. The following procedures are used to calibrate the upper and lower go/no-go level limits for the low and high frequency groups for zero loop and maximum loop conditions for the first of two set types.

NOTE

The ac voltmeter used in the following procedures must be a high impedance type such as a VTVM.

3.9 Zero Loop, Low Frequency Group Limit Calibration. To calibrate the upper and lower level limits, perform the following steps:

a. Determine the acceptable deviations above and below the reference telephone set low frequency group nominal level.

b. Set ZERO LOOP/MAX LOOP switch to ZERO LOOP, NORM/EXT FREQ COUNTER switch to NORM, and SET TYPE switch fully counterclockwise.

c. Connect first type reference set to L1, L2 and G terminals on TTS 66C Control Panel.

NOTE

It may be necessary to reverse L1 and L2 connections to obtain proper set operation.

d. On TTS 66C Control Panel, Set POWER switch to OFF.

e. Loosen the four front panel screws and remove TTS 66XTSA chassis from case.

f. Remove circuit card 6, insert 22 pin card extender in slot 6, and insert card 6 into extender.

g. On TTS 66C Control Panel, set POWER switch to ON.

h. On circuit card 6, connect VTVM across TP2 and TP3.

i. Set VTVM to 0dB range.

j. Press telephone set button 5 and on circuit card 6 adjust R605 to obtain VTVM indication that is below -8 dB by an amount equal to low frequency group lower level deviation limit. For example: if low frequency group lower level limit is 3 dB below nominal level, correct VTVM indication is -11 dB.

k. Press button 5 and adjust R616 until LO GROUP LEVEL indicator is not lighted and then in opposite direction until LO GROUP LEVEL indicator is just lighted.

l. Press button 5 and adjust R605 to obtain VTVM indication that is above -8 dB by an amount equal to low frequency group upper level deviation limit.

m. Press button 5 and adjust R615 until LO GROUP LEVEL indicator is not lighted and then in opposite direction until LO GROUP LEVEL indicator is just lighted.

n. Press button 5 and adjust R605 to obtain VTVM indication of -8 dB.

3.10 Zero Loop, High Frequency Group Limit Calibration. To calibrate the upper and lower level limits, perform the following steps:

a. Determine the acceptable deviation above and below the reference telephone set high frequency group nominal level.

b. Connect VTVM across TP1 and TP2.

c. Press button 5 and adjust R601 to obtain VTVM indication that is below -8 dB by an amount equal to high frequency group lower level deviation limit.

d. Press button 5 and adjust R611 until HI GROUP LEVEL indicator is not lighted and then in opposite direction until HI GROUP LEVEL indicator is just lighted.

e. Press button 5 and adjust R601 to obtain VTVM indication that is above -8 dB by an amount equal to high frequency group upper level deviation limit.

f. Press button 5 and adjust R610 until HI GROUP LEVEL indicator is not lighted and then in opposite direction until HI GROUP LEVEL indicator is just lighted.

g. Press button 5 and adjust R601 to obtain VTVM indication of -8 dB.

h. On SET TYPE switch marker strip above position 1, mark OLP and set type.

3.11 Maximum Loop Calibration. To calibrate the maximum loop low and high frequency group nominal levels, perform the following steps.

a. Set ZERO LOOP/MAX LOOP switch to MAX LOOP and SET TYPE switch to position 2.

b. Connect 0 to 100mA ammeter to EXT CURRENT METER jacks.

c. Press CURRENT CHECK button and adjust CURRENT ADJ potentiometer to obtain ammeter indication of desired maximum loop current for first set type.

d. remove ammeter.

e. Connect VTVM to TP1 and TP2.

f. Press button 5 and adjust R602 to obtain VTVM indication of -8 dB.

g. Connect VTVM to TP2 and TP3.

h. Press button 5 and adjust R606 to obtain VTVM indication of -8 dB.

i. On SET TYPE switch marker strip above position 2, mark MAX LP, set type, and max loop current level.

j. If the TTS 66XTSA is to be calibrated for a second set type, proceed to paragraph 3.12.

k. On TTS 66C Control Panel, set POWER switch to OFF.

1. Remove card 6 from card extender, remove extender, replace card 6, store extender.

m. Place chassis in case and tighten the four screws.

3.12 TTS 66XTSA CALIBRATION-SECOND SET TYPE. The following procedures are used to set the low and high frequency groups nominal level calibration for the second set type. The upper and lower level go/no-go limits of the first and second types must be identical to use this procedure.

3.13 Zero Loop, Low Frequency Group Calibration. To calibrate the low frequency group nominal level, perform the following steps:

a. Set ZERO LOOP/MAX LOOP switch to ZERO LOOP and NORM/EXT FREQ COUNTER switch to NORM.

b. On TTS 66C Control Panel, connect second reference set type to L1, L2 and G terminals.

NOTE

It may be necessary to reverse L1 and L2 connections to obtain proper set operation.

c. Connect VTVM to TP2 and TP3.

d. Press button 5 and adjust R607 to obtain VTVM indication of -8 dB.

3.14 Zero Loop, High Frequency Group Calibration. To calibrate the high frequency group nominal level, perform the following steps:

a. Connect VTVM to TP1 and TP2.

b. Press button 5 and adjust R603 to obtain VTVM indication of -8 dB.

c. On SET TYPE switch marker strip above position 3, mark OLP and set type.

3.15 Maximum Loop Calibration. To calibrate the low and high frequency group nominal levels, perform the following steps:

a. Set SET TYPE switch to position 4, and ZERO LOOP/MAX LOOP switch to MAX LOOP.

b. Connect 0 to 100mA ammeter to EXT CURRENT METER jacks.

c. Press CURRENT CHECK button and adjust CURRENT ADJ potentiometer to obtain ammeter indication of desired maximum loop current for second set type.

d. Remove ammeter.

e. Connect VTVM to TP1 and TP2.

f. Press button 5 and adjust R604 to obtain VTVM indication of -8 dB.

g. Connect VTVM to TP2 and TP3.

h. Press button 5 and adjust R608 to obtain VTVM indication of -8 dB.

i. On SET TYPE switch marker strip above position 4, mark MAX LP, set type,and max loop current level.

j. On TTS 66C Control Panel, set POWER switch to OFF.

k.. Remove card 6 from card extender, remove extender, replace card 6, and store extender.

l. Place chassis in case and tighten the four screws.

3.16 TELEPHONE SET TEST PROCEDURE. To test one or two set types that are identical to those used for calibration, perform the following steps:

a. On TTS 66C Control Panel, set POWER switch to ON, TEST SEQUENCE switch to REMOTE CONTROL, and connect telephone set to L1, L2 and G terminals.

NOTE

Allow equipment to stabilize for five minutes before proceeding.

NOTE

It may be necessary to reverse L1 and L2 connections to obtain proper set operation.

b. Press LAMP CHECK button. All indicators must be lighted. The red LEVEL DEF indicator should be lighted at all times when no test tones are entering TTS 66XTSA. Replace any defective indicator lamps before proceeding.

c. Set SET TYPE switch to either position 1 or position 3 as required, ZERO LOOP/MAX LOOP switch to ZERO LOOP, and NORM/EXT FREQ COUNTER switch to NORM.

d. Press button 1. LO GROUP and HI GROUP LEVEL indicators must be lighted and LEVEL DEF indicator must not be lighted.

e. Press button 5. LO GROUP and HI GROUP LEVEL and DIGIT 5 (FREQ CK) indicators must be lighted and LEVEL DEF indicator must not be lighted.

f. Press button 9. LO GROUP and HI GROUP LEVEL indicators must be lighted and LEVEL DEF indicator must not be lighted.

g. Press button 0. LO GROUP and HI GROUP LEVEL indicators must be lighted and LEVEL DEF indicator must not be lighted

h. Set SET TYPE switch to either position 2 or position 4 as required and set ZERO LOOP/MAX LOOP switch to MAX LOOP.

i. Connect 0 to 100mA ammeter to EXT CURRENT METER Jacks.

j. Press CURRENT CHECK button and adjust CURRENT ADJ potentiometer to obtain ammeter indication that corresponds to marking on SET TYPE switch marker strip above position selected.

k. Remove ammeter.

l. Repeat steps d through g.

m. To obtain exact frequency measurements, connect electronic frequency counter to EXT FREQ COUNTER jacks, set NORM/EXT FREQ COUNTER switch to EXT FREQ COUNTER, and simultaneously press buttons in pairs as indicated in table 3-2.

Table 3-2. Standard 10-Button Telephone Set Frequencies

TONE FREQ	PRESS BUTTONS
697 Hz	1 & 2
770 Hz	4 & 5
852 Hz	7 & 8
1209 Hz	1 & 4
1336 Hz	2 & 5
1477 Hz	3 & 6

3.17 TTS 66C CONTROL PANEL MODIFICATION.

3.18 To modify control panels having serial numbers of 105 and lower, perform the following steps.

a. Remove the two red wires and strap from S4-D1-WB. Deck 1 is close to the front panel and wiper B is at the top, (Figure 3-2).

b. Remove strap from S4-D1-WA.

c. Connect two red wires removed in step a to S4-D1-WA.

d. Connect S4-D1-WB to RM-ONC-5

e. Strap RM-ONC-6 to RM-D1-H.

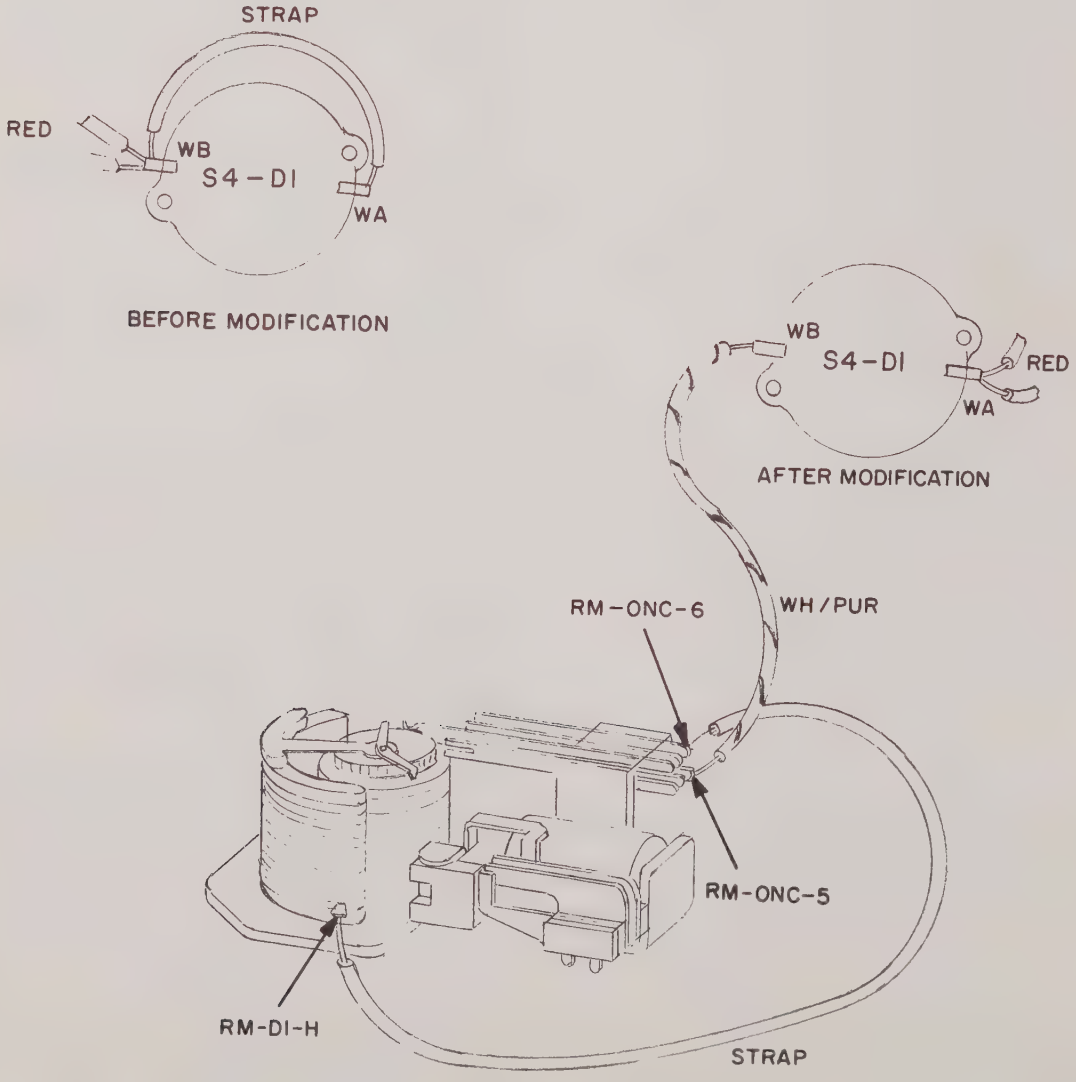


Figure 3-2. TTS 66C Control Panel Switch Wiring

SECTION 4

CIRCUIT DESCRIPTION

4.1 GENERAL.

4.2 Paragraphs 4.3 through 4.5 provide a block diagram level description of the TTS 66XTSA and paragraphs 4.6 through 4.12 the detailed circuit descriptions.

4.3 BLOCK DIAGRAM DESCRIPTION.

4.4 When TEST SEQUENCE switch S4 (fig. 7-1) is in the REMOTE CONTROL position, the L1 and L2 telephone set leads at J14 or J10 and J11 are applied through interface connectors to the normally open contracts of K2 in the TTS 66XTSA. If the RM stepping switch is in the home position, battery voltage is applied to K2 and the L1 and L2 inputs are applied to the input circuits.

4.5 Telephone set operating current is applied through normally closed CURRENT CHECK switch S2 (fig. 4-1) and either directly through S1 or through CURRENT ADJ potentiometer R1 when S1 is in MAX LOOP position. To measure set current with an external ammeter, CURRENT CHECK switch S2 is pressed to remove the short across the ammeter. The low and high group tones on L1 are ac coupled and applied through the normally closed contacts of S3 to the input amplifier on card 3. The tones can be monitored on external test equipment when S3 is set to EXT FREQ COUNTER. On card 3, the tones are amplified and applied to low and high band reject filters that separate the input into low and high frequency groups. The separated groups are applied to limiting amplifiers and then to 770 Hz and 1336 Hz detectors on card 4. When button 5 on the telephone set under test is pushed, 770 Hz and 1336 Hz tones are generated. The detector outputs are applied to a NAND circuit on card 5 and the DIGIT 5 (FREQ CK) indicator is lighted. In addition, separated groups are applied to level set circuits that determine the nominal level and the deviation limits above and below this level that are used to calibrate the threshold detectors that follow. When both the low group and high group levels are within the preset limits, the LO GROUP and HI GROUP LEVEL indicators are lighted and the DEF indicator is not lighted. When either of the tones is outside of the preset limits, the DEF indicator is lighted and the associated LEVEL indicator is not lighted.

4.6 DETAILED CIRCUIT DESCRIPTION.

4.7 Paragraphs 4.8 through 4.12 contain detailed circuit descriptions of the five different cards that comprise the TTS 66XTSA.

4.8 AC INPUT CARD 3. The ac input card (fig. 7-4) consists of two identical active high pass filters, two passive band reject filters and two identical limiter amplifiers. The two halves of U1 are the active portions of the high pass filters. Capacitors C1 and C2 and resistors R1 and R2 determine the cutoff frequency. Resistors R3 and R4 set the stage gain in the pass band at approximately 6 dB. The output of the second active filter is applied to band reject filters of identical type to separate the composite tone input into the low and high frequency groups. The filter consisting of inductors L1, L2 and L3 and capacitors C9 through C11 and C19 through C21 rejects the high group tones and passes the low group tones to the output limiting amplifier and to circuits on other cards. The other band reject filter passes the high group tones and rejects the low group. The two halves of U2 form the two output limiting amplifiers. Using the low group amplifier as an example, the stage functions as a high gain amplifier until varistor RV1 begins to conduct and limits the output.

4.9 COMPONENT CARD 6. This card consists of identical low and high group level set calibration circuits, two Zener diode regulated power supplies, and isolation diodes. Potentiometers R601 through R604 calibrate the high frequency group nominal levels. The high group high level limit is calibrated by R610 and the low level limit by R611. Resistors R605 through R608 and R614 through R617 are used to calibrate the low group. Resistor R613 and Zener diode CR601 provide a regulated -24 volts dc for card 1 and R618 and CR602 provide the same for card 2. Diodes CR605 through CR607 provide isolation between LAMP CHECK switch S5 and the circuits that drive indicators DS1, DS2 and DS4. Diodes CR603 and CR604 are part of an OR gate used to drive DS3.

4.10 DUAL THRESHOLD DETECTOR CARDS 1 and 2. This card (fig. 7-3) consists of two identical threshold detectors and output lamp

drivers. A typical detector consists of amplifier Q1; emitter follower Q2; voltage doubler rectifier C2, CR1, R5, and C3; and Schmitt trigger Q3-Q4. During normal operation, when the inputs are within preset limits, the rectified voltage at test point 1 is sufficiently negative to set the Schmitt trigger so that Q3 is conducting and Q4 is cut off. At the same time, the rectified voltage at test point 4 is not negative enough to cause Q9 to conduct and as a result, Q10 conducts. With the Schmitt triggers in the states just described, DEF lamp drivers Q6 and Q12 are cut off and the DEF indicator lamp is not lighted. With both Q6 and Q12 cut off, Q13 saturates and the associated HI GROUP or LO GROUP LEVEL indicator is lighted. When the input level drops below the preset minimum level, Schmitt trigger Q3-Q4 changes state but Schmitt trigger Q9-Q10 remains unchanged. With Q4 conducting, Q5 is cut off and DEF lamp driver Q6 is saturated. In addition, Q13 is cut off and the associated LEVEL indicator lamp is not lighted. When the input level exceeds the preset level, Schmitt trigger Q9-Q10 changes state, Q11 and Q12 conduct, and the DEF indicator is lighted. Transistor Q13 again keeps the associated LEVEL indicator lamp not lighted.

4.11 SELECTIVE DETECTOR CARD 4. The selective detector card (fig. 7-5) consists of 1336 Hz and 770 Hz tone detectors. If both tones are present at the same time, the DIGIT 5 (FREQ CK) indicator is lighted. Each detector consists of two cascaded active filters and an output relay and driver. The active filters contain a Wien bridge in the feedback path. The first filter is tuned to approximately 1.5 percent below the nominal tone frequency and the second to 1.5 percent above. The filter output is applied to the relay driver that energizes the associated relay and removes ground from the normally closed contacts.

4.12 COMPONENT CARD 5. This card (fig. 7-2) provides a number of miscellaneous functions. Resistor R501 and capacitor C502 form the standard 900Ω, 2μF telephone set load. Varistors RV501 through RV503 provide overload protection. Resistors R502 through R504 and capacitors C504 and C505 provide approximately -16 Vdc and -32 Vdc to card 3. Resistors R505 and R506 are the series dropping resistors for the relay coils on card 4. Transistor Q501 in conjunction with diodes CR501 and CR502 form a NAND gate. When both normally closed relay contacts on card 4 are open, Q501 is saturated and DIGIT 5 (FREQ CK) indicator DS1 is lighted.

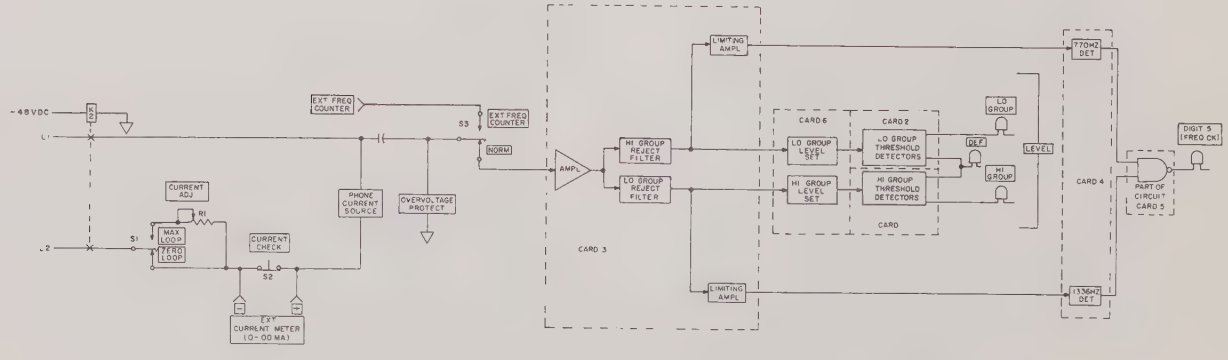


Figure 4-1. Model TTS 66XTSA Functional Block Diagram.

SECTION 5

MAINTENANCE AND CALIBRATION

5.1 GENERAL

5.2 The calibration procedures given in paragraphs 3.8 through 3.17 should be repeated at frequent intervals to ensure that calibration remains valid. If any adjustments are made the entire procedure should be performed.

SECTION 6

ELECTRONIC PARTS LIST

6.1 INTRODUCTION.

6.2 The following pages contain the parts list for the Model TTS 66XTSA Tone Signaling Adapter.

6.3 FSCM CODE NUMBERS.

6.4 This is the Federal Supply Code of Manufacturers as issued October 1969. A list of codes and their respective manufacturers is given below.

LIST OF MANUFACTURERS

Code No.	Manufacturer
01121	Allen Bradley Milwaukee, Wis. 53204
01295	Texas Instruments Inc. Dallas, Texas 75231
02660	Amphenol Corp. Broadview, Ill. 60153
04221	Midtex Inc. Mankato, Minn. 56001
04773	Automatic Electric Co. Northlake, Ill. 60614
05397	Union Carbide Corp. N.Y., N. Y. 10017
06486	IRC Division of TRW Lynn, Mass. 01905
06819	Northeast Electronics Corp. Concord, N. H. 03301
12065	Transitron Electric Corp. Boston, Mass. 02128
13606	Sprague Electric Co. Concord, N. H. 03301
15873	Motorola Inc. Arcade, N. J. 14009
17803	Fairchild Semicondictor Div. Mountain View, Calif. 94041
49956	Raytheon Co. Lexington, Mass. 02173
71450	CTS Corp. Elkhart, Ind. 46514
71590	Centralab Milwaukee, Wis. 53201
72136	Electro Motive Mfg. Willimantic, Conn. 06226
80368	Sylvania Electric Inc. N.Y., N. Y. 10017
81073	Grayhill, Inc. La Grange, Ill. 60525
82389	Switchcraft Inc. Chicago, Ill. 60630
95073	Douglas Randall Inc. Westerly, R.I. 02891

Dual Threshold Detector
PC Bd. E95146 (Card 1&2)

Ref Desig.	Description	Manufacturer (FSCM Code No.)	Part Number
R1	R: 680K, 10%, ½W	01121	EB
R2	R: 2800, 1%, 1/8W	06486	CEATO
R3	R: 4300, 5%, ½W	01121	EB
R4	R: 30.90K, 1%, 1/8W	06486	CEATO
R5	R: 5100, 5%, ½W	01121	EB
R6	R: 100K, 10%, ½W	01121	EB
R7	R: 10K, 1%, 1/8W	06486	CEATO
R8	R: 470, 5%, ½W	01121	EB
R9	R: 4990, 1%, 1/8W	06486	CEATO
R10	R: Variable 10K	71590	340PC103B
R11	R: 75K, 1%, 1/8W	06486	CEATO
R12	R: 9090, 1%, 1/8W	06486	CEATO
R13	R: 22K, 10%, ½W	01121	EB
R14	R: 200K, 5%, ½W	01121	EB
R15	R: 30K, 5%, ½W	01121	EB
R16	R: 12K, 10%, ½W	01121	EB
R17	R: 680K, 10%, 1/8W	01121	EB
R18	R: 2800, 1%, 1/8W	06486	CEATO
R19	R: 4300, 5%, ½W	01121	EB
R20	R: 30.90K, 1%, 1/8W	06486	CEATO
R21	R: 5100, 5%, ½W	01121	EB
R22	R: 100K, 10%, ½W	01121	EB
R23	R: 22.1K, 1%, 1/8W	06486	CEATO
R24	R: 470, 5%, ½W	01121	EB
R25	R: 4990, 1%, 1/8W	06486	CEATO
R26	R: Variable 10K	71590	340PC103B
R27	R: 61.9K, 1%, 1/8W	06486	CEATO
R28	R: 9090, 1%,1/8W	06486	CEATO
R29	R: 22K, 10%, ½W	01121	EB
R30	R: 200K, 5%, ½W	01121	EB
R31	R: 30K, 5%, ½W	01121	EB
R32 and R33	R: 12K, 10%, ½W	01121	EB
C1	C: 0.01μF, 80V dc	13606	225P
C2	C: 1μF, 25V dc	13606	5C13
C3	C: 2μF, 15V dc	13606	TE-1149
C4	C: 0.01μF, 80V dc	13606	225P
C5	C: 1μF, 25V dc	13606	5C13
C6	C: 2μF, 15V dc	13606	TE-1149
Q1	Transistor, PNP	17803	2N4355
Q2 thru Q5	Transistor, PNP	17803	2N4354
Q6	Transistor, PNP	17803	2N4356
Q7	Transistor, PNP	17803	2N4355
Q8 thru Q11	Transistor, PNP	17803	2N4354
Q12 and Q13	Transistor, PNP	17803	2N4356
CR1 thru CR4	Diode	01295	1N198
CR5	Diode	01295	1N4003

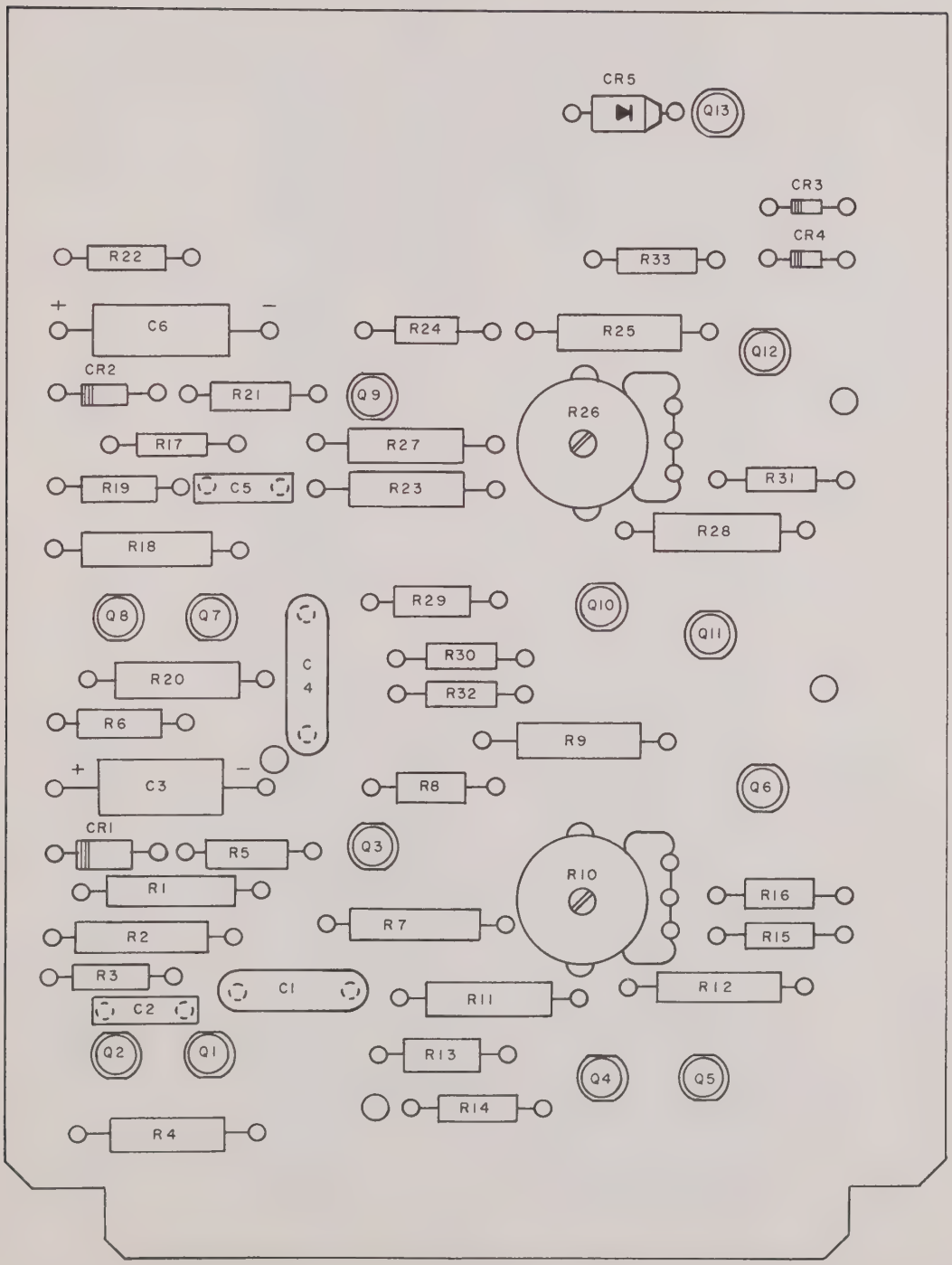


Figure 6-1. Threshold Detector Cards 1 and 2, E95146, Component Location.

AC Input
PC Bd. E95458-3 (Card 3)

Ref Desig.	Description	Manufacturer (FSCM Code No,)	Part Number
R1	R: 38.3K, 1%, 1/8W	19701	MF5C
R2	R: 75K, 1%, 1/8W	19701	MF5C
R3 and R4	R: 22K, 10%, $\frac{1}{4}$W	01121	CB
R5	R: 1500, 10%, $\frac{1}{4}$W	01121	CB
R6	R: 38.3K, 1%, 1/8W	19701	MF5C
R7	R: 75K, 1%, 1/8W	19701	MF5C
R8 and R9	R: 22K, 10%, $\frac{1}{4}$W	01121	CB
R10	R: 1500, 10%, $\frac{1}{4}$W	01121	CB
R11	R: 120, 10%, $\frac{1}{4}$W	01121	CB
R12	R: 10K, 10%, $\frac{1}{4}$W	01121	CB
R13	R: 220, 10%, $\frac{1}{4}$W	01121	CB
R14	R: 10K, 10%, $\frac{1}{4}$W	01121	CB
R15	R: 1500, 10%, $\frac{1}{4}$W	01121	CB
R16	R: Variable, 5K, 30%	71590	UPE200RE1
R17	R: 330, 10%, $\frac{1}{4}$W	01121	CB
R18	R: 10K, 10%, $\frac{1}{4}$W	01121	CB
R19	R: 220, 10%, $\frac{1}{4}$W	01121	CB
R20	R: 10K, 10%, $\frac{1}{4}$W	01121	CB
R21	R: 1500, 10%, $\frac{1}{4}$W	01121	CB
R22	R: Variable, 5K	71590	UPE200RE1
R23 and R24	R: 4700, 10%, $\frac{1}{4}$W	01121	CB
C1 and C2	C: 0.01μF, 100V dc	13606	225P
C3	C: 0.005μF, 100V dc	13606	225P
C4	C: 200pF, 500V dc	72136	CM15ED201JN3
C5 and C6	C: 0.01μF, 100V dc	13606	225P
C7	C: 0.005μF, 100V dc	13606	225P
C8	C: 200pF, 500V dc	72136	CM15ED201JN3
C9 and C10	C: 0.33μF, 75V dc	13606	225P
C11	C: 0.27μF, 75V dc	13606	225P
C12	C: 0.005μF, 100V dc	13606	225P
C13	C: 200pF, 500V	72136	CM15ED201JN3
C14 and C15	C: 0.33μF, 75V dc	13606	225P
C16	C: 0.27μF, 75V dc	13606	225P
C17	C: 0.005μF, 100V dc	13606	225P
C18	C: 200pF, 500V dc	72136	CM15ED201JN3
C19 thru C21	C: Selected value	13606	225P
C22 and C23	C: 0.33μF, 75V dc	13606	225P
C24 thru C26	C: Selected value	13606	225P
U1 and U2	Integrated circuit	12065	TOA2809
L1	Inductor, 37.4mH	ABLE	37R4-11
L2	Inductor, 51mH	ABLE	51R05-12
L3	Inductor, 37.4mH	ABLE	37R4-11
L4	Inductor, 82.9mH	ABLE	82R9-26
L5	Inductor, 104mH	ABLE	104-18
L6	Inductor, 82.9mH	ABLE	82R9-26

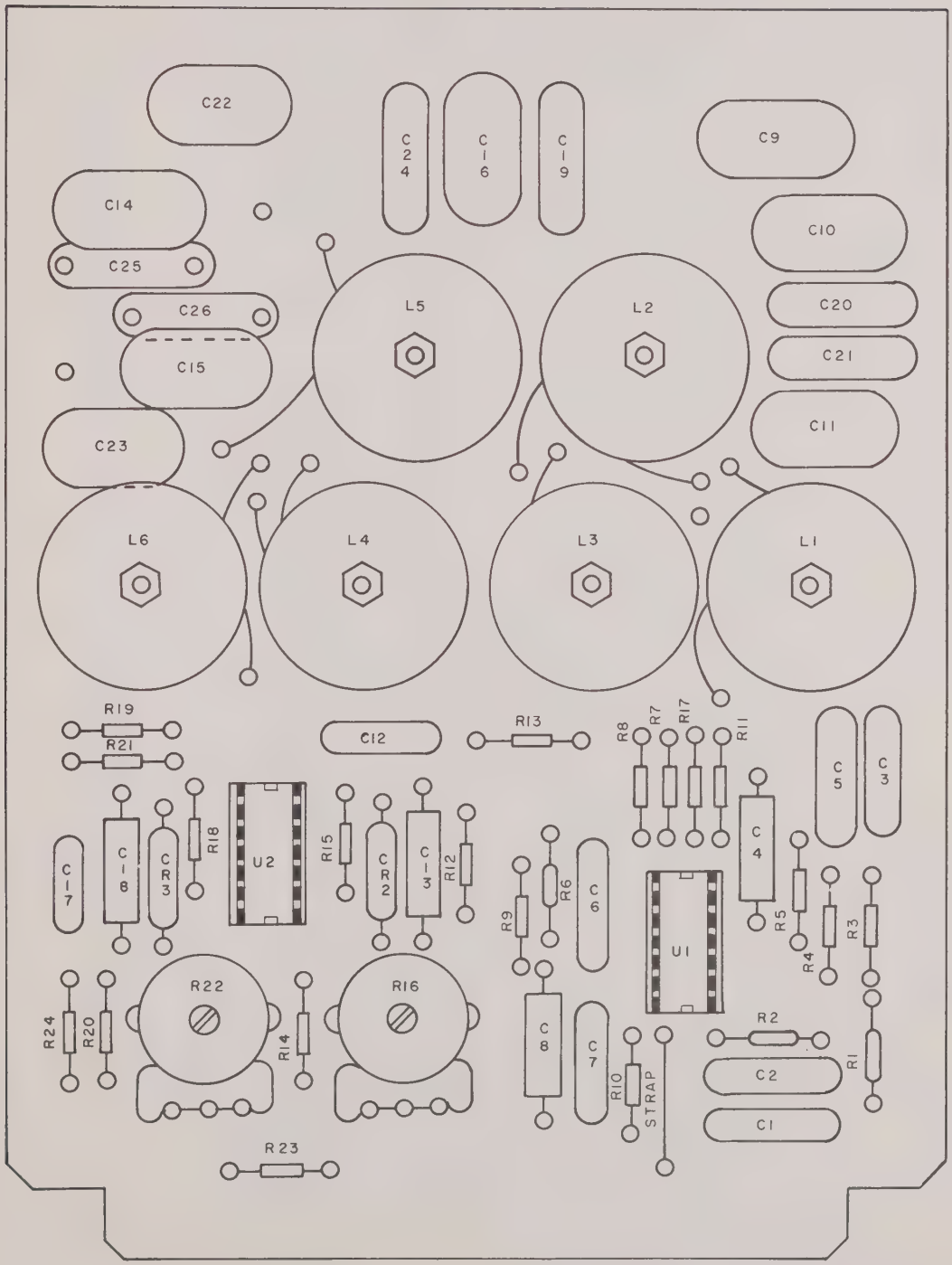


Figure 6-2. AC Input Card 3, E95458-3, Component Location.

Selective Detector
PC Bd. E95236 (Card 4)

Ref Desig.	Description	Manufacturer (FSCM Code No.)	Part Number
R1	R: 100K, 10%, ½W	01121	EB
R2	R: 4420, 1%, 1/8W	19701	MF5C
R3	R: 7870, 1%, 1/8W	19701	MF5C
R4	R: 1500, 10%, ½W	01121	EB
R5	R: Selected value ½W	01121	EB
R6	R: 13K, 1%, 1/8W	06486	CEATO
R7	R: Selected value ½W	01121	EB
R8	R: 13K, 1%, 1/8W	06486	CEATO
R9	R: 100K, 10%, ½W	01121	EB
R10	R: 4420, 1%, 1/8W	19701	MF5C
R11	R: 7870, 1%, 1/8W	19701	MF5C
R12	R: 1500, 10%, ½W	01121	EB
R13	R: Selected value	01121	EB
R14	R: 13K, 1%, 1/8W	19701	MF5C
R15	R: Selected value ½W	01121	EB
R16	R: 13K, 1%, 1/8W	19701	MF5C
R17	R: 10K, 5%, ½W	01121	EB
R18	R: 100K, 10%, ½W	01121	EB
R19	R: 4420, 1%, 1/8W	19701	MF5C
R20	R: 7870, 1%, 1/8W	19701	MF5C
R21	R: 1500, 10%, ½W	01121	EB
R22	R: Selected value ½W	01121	EB
R23	R: 22.6K, 1%, 1/8W	19071	MF5C
R24	R: Selected value ½W	01121	EB
R25	R: 22.6K, 1%, 1/8W	06486	CEATO
R26	R: 100K, 10%, ½W	01121	EB
R27	R: 4420, 1%, 1/8W	19701	MF5C
R28	R: 7870, 1%, 1/8W	19701	MF5C
R29	R: 1500, 10%, ½W	01121	EB
R30	R: Selected value ½W	01121	EB
R31	R: 22.6K, 1%, 1/8W	19701	MF5C
R32	R: Selected value ½W	01121	CEATO
R33	R: 22.6K, 1%, 1/8W	19701	MF5C
R34	R: 10K, 10%, ½W	01121	EB
R35 and R36	R: 3K, 5%, ½W	01121	EB
R37	R: 1200, 10%, 1W	01121	GB
R38 thru R41	R: Variable, 1K, 30%	71590	UPE200RE1
C1	C: 0.01μF, 100V dc	13606	225P
C2	C: 0.001μF, 100V dc	13606	225P
C3	C: 36pF, 500V dc	72136	CM15E360J
C4 and C5	C: 0.01μF, 1%, 35V dc	13606	490P1036R35
C6	C: 0.001μF, 100V dc	13606	225P
C7	C: 36pF, 500V dc	72136	CM15E360J
C8 and C9	C: 0.01μF, 1%, 35V dc	13606	490P1036R35
C10	C: 2.2μF, 35V dc	05397	KR22W35K
C11	C: 0.47μF, 50V dc	05397	KR47W50K
C12	C: 0.01μF, 100V dc	13606	225P
C13	C: 0.001μF, 100V dc	13606	225P
C14	C: 36pF, 500V dc	72136	CM15E360J
C15 and C16	C: 0.01μF, 35V dc	13606	490P
C17	C: 0.001μF, 100Vdc	13606	225P
C18	C: 36pF, 500V dc	72136	CM15E306J
C19 and C20	C: 0.01μF, 35V dc	13606	490P
C21	C: 2.2μF, 35V dc	05397	KR22W35K

Selective Detector
PC Bd. E95236 (Card 4) (cont)

Ref Desig	Description	Manufacturer (FSCM Code No.)	Part Number
C22	C: 0.47μF, 50V dc	05397	KR47W50K
C23 and C24	C: 20μF, 50V dc	13606	TE1305
K1 and K2	Relay, 24V	95073	24MC1C
U1 thru U4	Integrated circuit	01295	SN72709
Q1 and Q2	Transistor, PNP	17803	2N4356
CR1 thru CR4	Diode	12065	1N4148

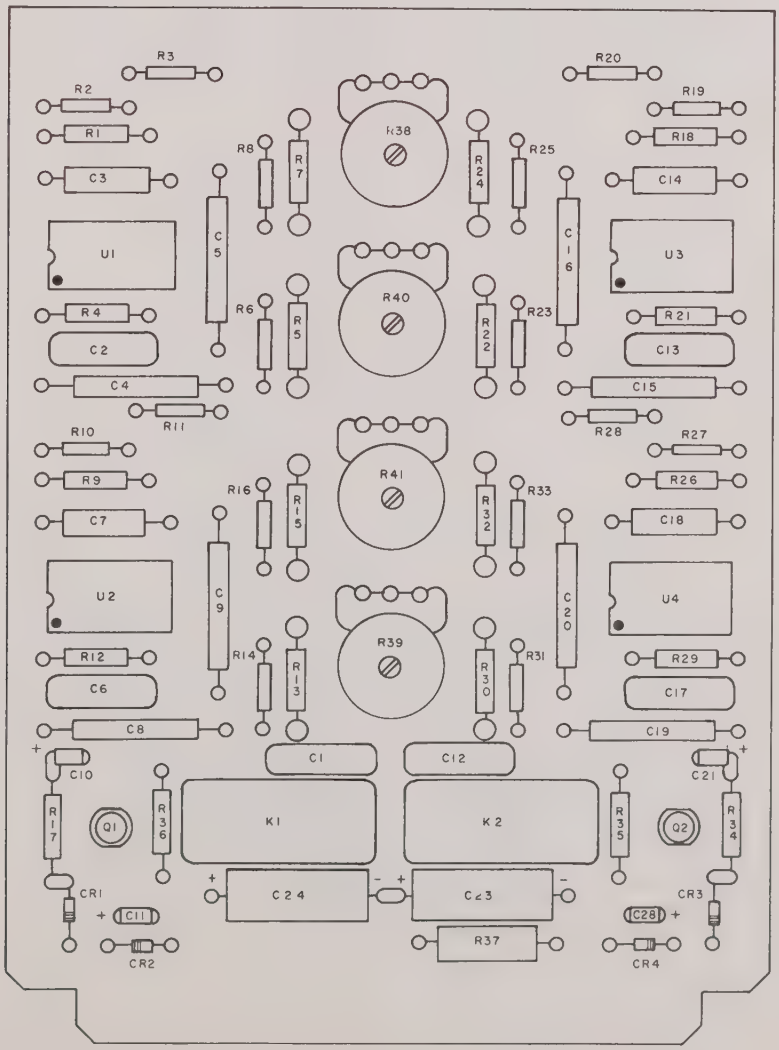


Figure 6-3. Selective Detector Card 4, E95236, Component Location.

PC Bd. E95542-2 (Card 5)

Ref Desig.	Description	Manufacturer (FSCM Code No.)	Part Number
R501	R: 900, 1%, $\frac{1}{2}$W	19701	MF5C
R502	R: 1200, 10%, 1W	01121	GB
R03 and R504	R: 3K, 5%, $\frac{1}{2}$W	01121	EB
R505 and R506	R: 3900, 5%, $\frac{1}{2}$W	01121	EB
R507	R: 24K, 5%, $\frac{1}{2}$W	01121	EB
C501 thru C503	C: 2μF, 10%, 200V	27735	D-20-200-10
C504 and C505	C: 20μF, 50V dc	13606	TE-1305
CR501 thru CR504	Diode	01295	1N4003
RV501 thru RV503	Varistor	81071	SV-1
Q501	Transistor, PNP	17803	2N4356

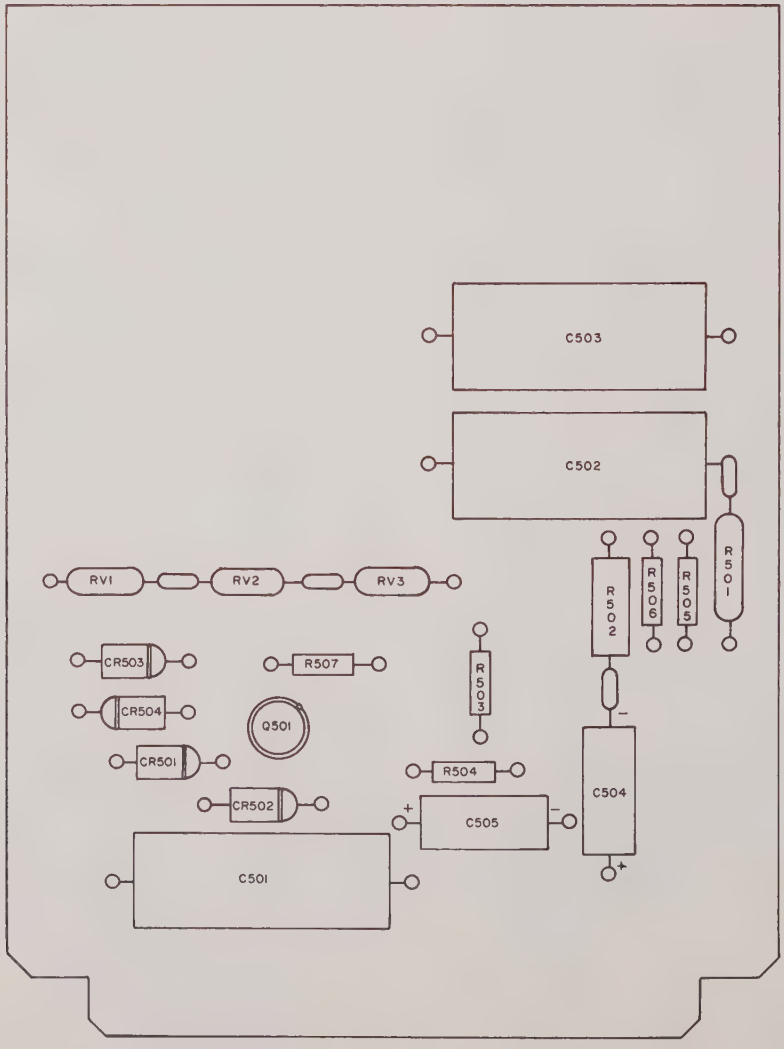


Figure 6-4. Card 5, E95542-2, Component Location.

PC Bd. E95541-1 (Card 6)

Ref Desig.	Description	Manufacturer (FSCM Code No.)	Part Number
R601 thru R608	R: Variable, 50K, 30%	71590	UPE200RE1
R609	R: 2610, 1%, 1/8W	19701	MF5C
R610 and R611	R: Variable, 10K	71590	UPE200RE1
R612	R: 3010, 1%, 1/8W	19701	MF5C
R613	R: 2K, 5%, $\frac{1}{2}$W	01121	EB
R614	R: 2610, 1%, 1/8W	19701	MF5C
R615 and R616	R: Variable, 10K	71590	UPE200RE1
R617	R: 3010. 1%, 1/8W	19701	MF5C
R618	R: 2K, 5%, $\frac{1}{2}$W	01121	EB
CR601 and CR602	Diode, zener, 24V	12954	1N3029B
CR603 thru CR608	Diode	01295	1N4003

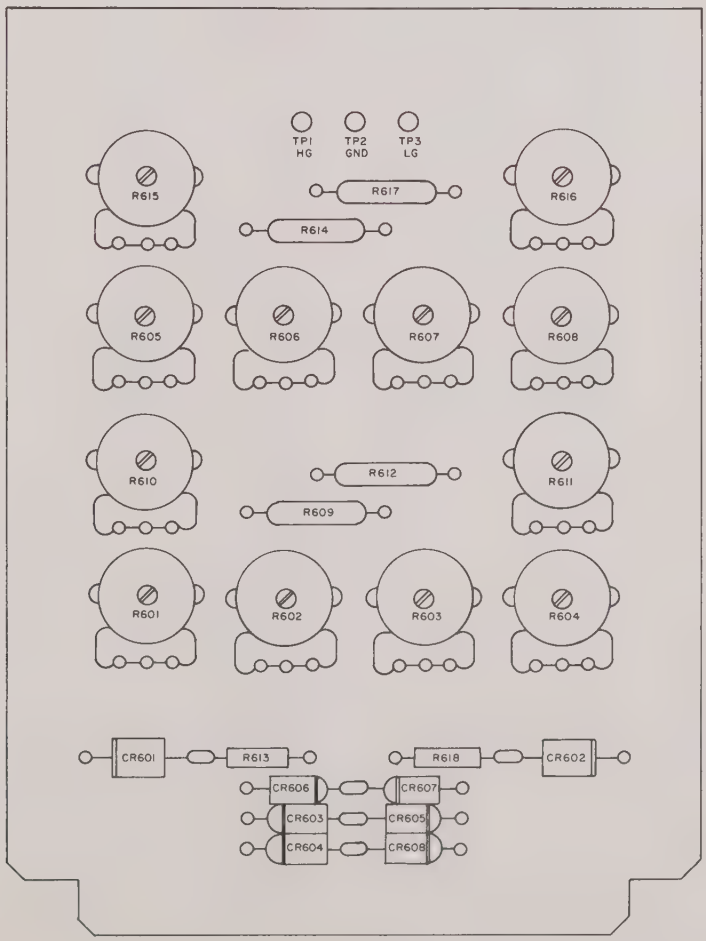


Figure 6-5. Card 6, E95541-1, Component Location.

Main Assembly

Ref Desig.	Description	Manufacturer (FSCM Code No.)	Part Number
R1	R: Variable, 2500, ww, 5W	71590	WN25Z
S1	Switch key, 2 pos.	78957	170E
S2	Switch, pushbutton, white	82389	10S-1038
S3	Switch, key, 2pos	78957	170E
S4	Switch, rotary 2 pol, 5pos	71590	PA-2003
S5	Switch, pushbutton, red	82389	903
DS1 thru DS4	Lamp, 60A	93332	60A
XDS1 thru XDS4	Lamp assembly	72619	105-4428-722
J1 thru J6	PC Socket, 22 pins	02660	480142-3
J7	Jack, pin, black	49956	TJ105BL
J8	Jack, pin, black	49956	TJ105BL
J9	Binding post red	81073	29-1R
J10	Binding post black	81073	29-1B
J11	Socket, 6 pin	02660	1-480-270-0
K1	Relay, type A	04773	1-480-2710
K2	Relay, 48V, 4C	04221	156-04D1A4
P3	Plug, 8 pin	02660	26-4302-8
P11	Plug, 6 pin	02660	1-480-271-0
Card 1 and Card 2	Dual threshold detector	06819	E95146
Card 3	AC input	06819	E95458-3
Card 4	Selective detector	06819	E95236
Card 5	Component bd,#5	06819	E95542-2
Card 6	Component bd,#6	06819	E95541-1

SECTION 7

SCHEMATIC DIAGRAMS

7.1 INTRODUCTION.

7.2 The following pages contain the schematic diagrams for the Model TTS 66XTSA Tone Signaling Adapter.

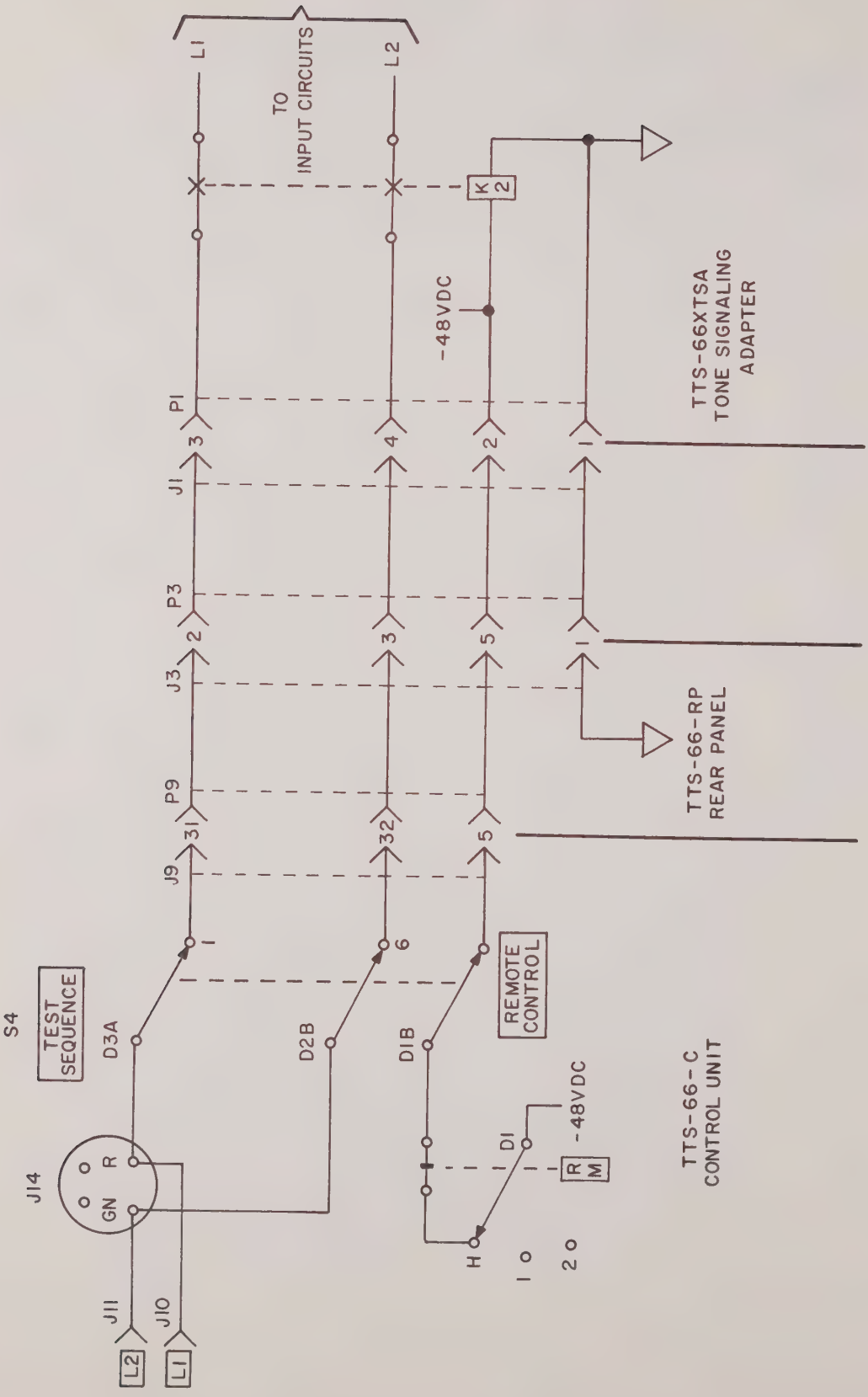
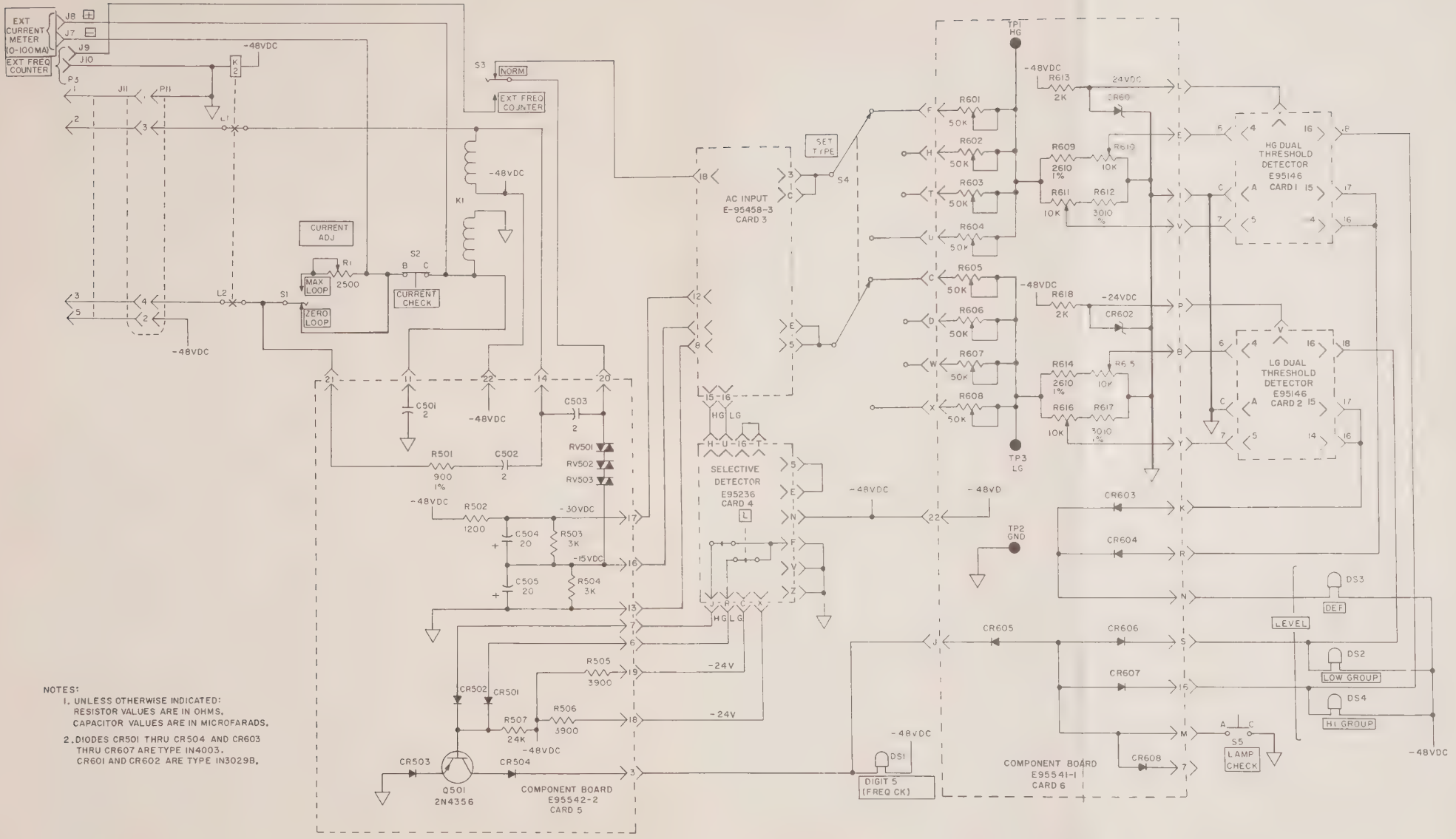


Figure 7-1. TTS 66C to TTS 66XTSA Interconnection Diagram.



NOTES:

1. UNLESS OTHERWISE INDICATED: RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN MICROFARADS.
2. DIODES CR501 THRU CR504 AND CR603 THRU CR607 ARE TYPE IN4003. CR601 AND CR602 ARE TYPE IN3029B.

Figure 7-2. TTS 66XTSA Interconnection Diagram

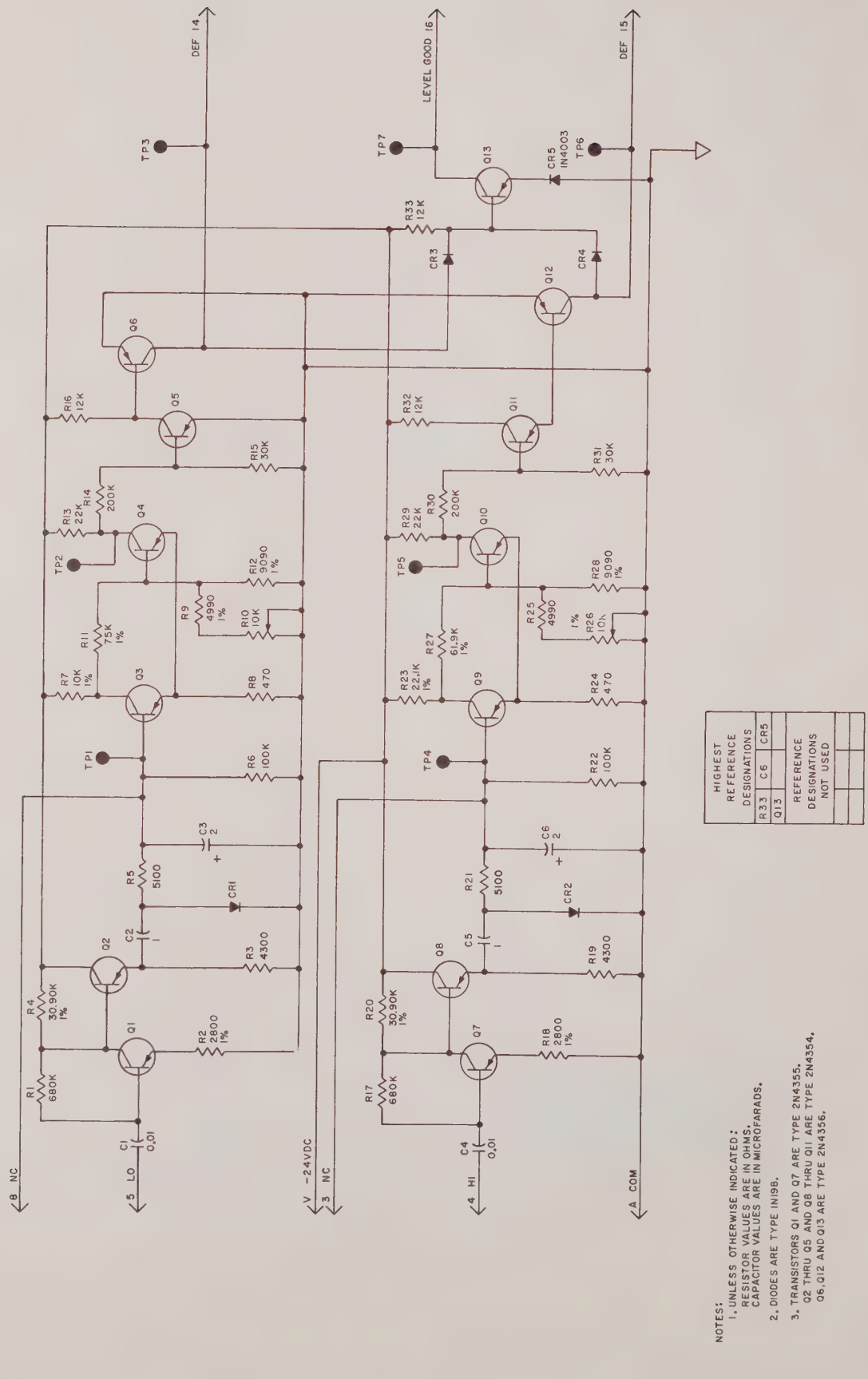


Figure 7-3. Dual Threshold Detector Cards 1 and 2, E95146, Schematic Diagram

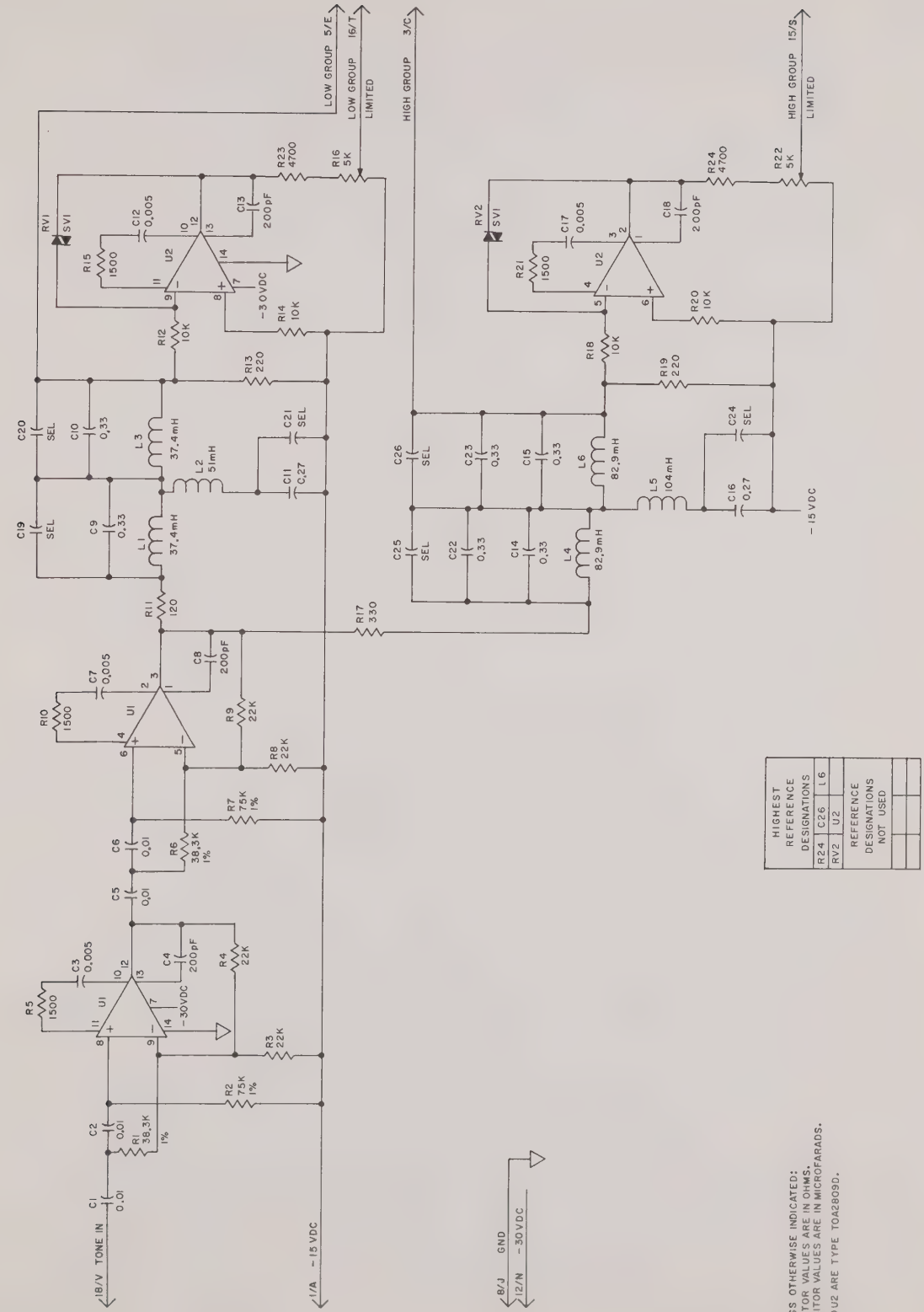


Figure 7-4. AC Input Card 3, E95458-3, Schematic Diagram

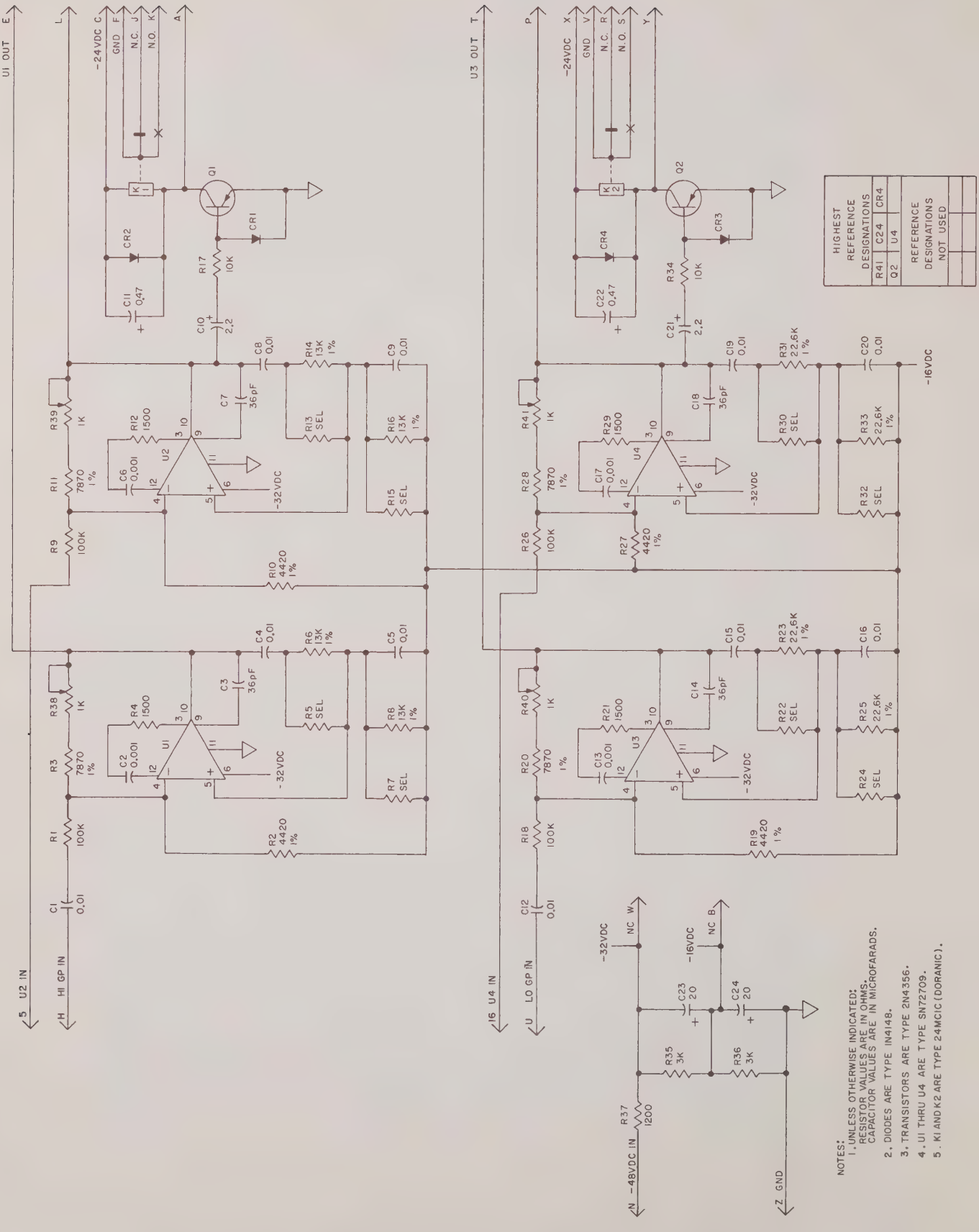


Figure 7-5. Selective Detector Card 4, E95236, Schematic Diagram.

85392